CHAPTER 5
ENGINEERING EVALUATION/COST ANALYSIS

5-1. Introduction.

a. This chapter presents an overview of the EE/CA phase of a RCWM response action. An EE/CA must be completed for all NTCRAs, as required by the NCP. The USAESCH OE Design Center is responsible for executing the EE/CA phase for RCWM projects.

b. The purpose of the EE/CA is to identify the most appropriate response action to address RCWM risk at a project site. The determination of the recommended response alternative occurs following the completion of a site characterization, risk assessment of RCWM hazards present at the site, and evaluation of potential response alternatives. The data generated to support the selection of a response alternative is presented in an EE/CA report. The components of the EE/CA phase are illustrated in Figure 5-1 and explained the paragraphs 5-2 through 5-9.

c. If an imminent hazard is discovered during the EE/CA phase, a TCRA may be initiated. Upon completion of the TCRA, the NTCRA process will resume. The TCRA process is discussed in Chapter 4 of this document and in EP 1110-1-18.

5-2. EE/CA Reconnaissance.

a. EE/CA Reconnaissance (RECON) is an optional task within the EE/CA phase. If implemented, the RECON task is the first element of the EE/CA phase. The decision to implement the RECON task is made by the RCWM project team on a project-by-project basis following an evaluation of the site-specific data gathered during the PAE and SI phases. The government or its contractor(s) may complete the RECON task. Additional information on the objectives and components of the RECON task are discussed in EM 1110-1-4009

5-3. EE/CA Planning and Coordination. The EE/CA planning and coordination process includes the preparation of the EE/CA SOW, independent government estimate (IGE), and schedule; completion of a site visit; preparation and approval of all required planning documentation; and fulfillment of the project management, regulatory, real estate and public participation requirements.

a. Preparation of the EE/CA SOW. The site-specific data gathered during the PAE, SI, and RECON (if implemented) is used to prepare the EE/CA SOW. The RCWM project team will manage the preparation of the SOW and ensure that all applicable technical disciplines are appropriately involved. Since safety is a primary concern during RCWM response projects, the EE/CA SOW must be closely coordinated with the project OE Safety Specialist. Additionally,

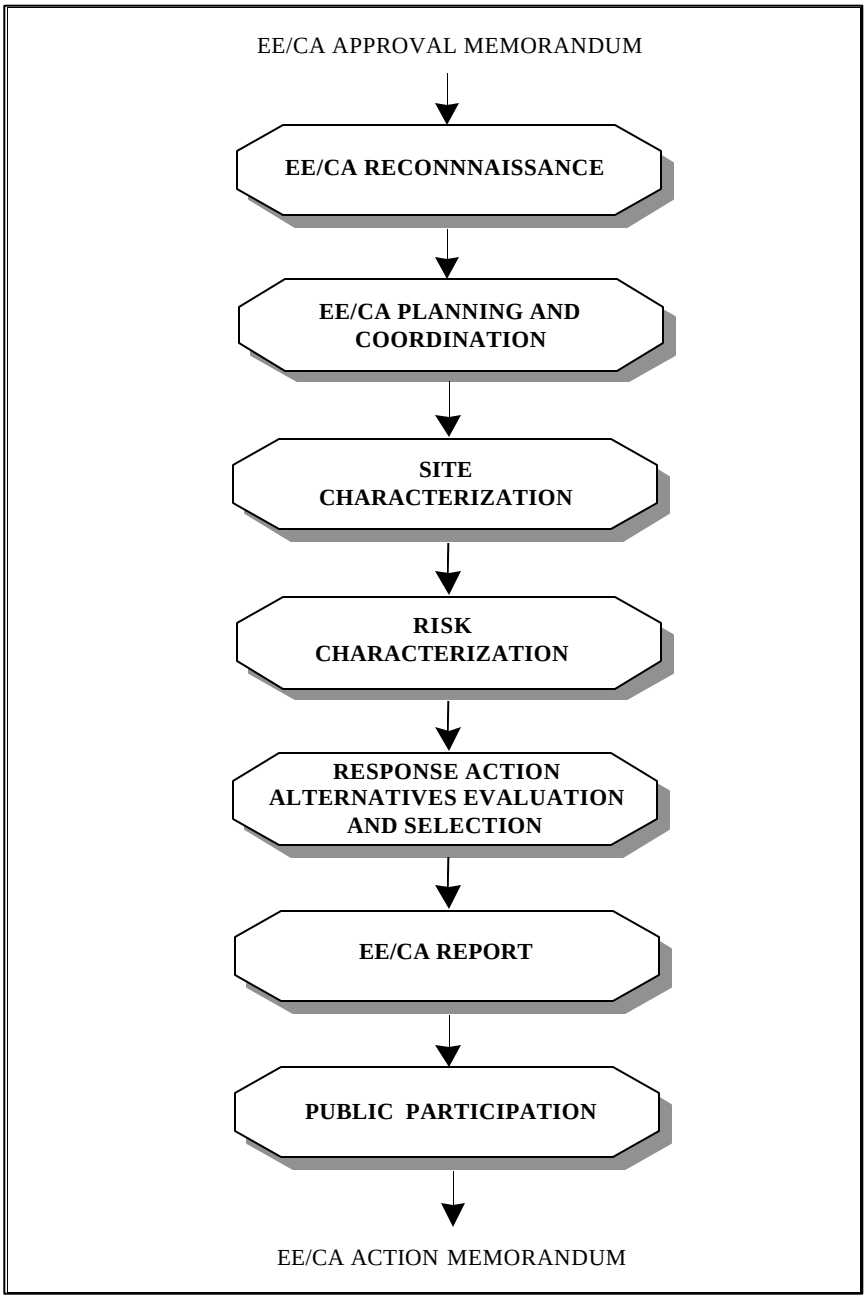

Figure 5-1. EE/CA Process

the OE MCX may be consulted to provide the appropriate statements concerning the background or authority for the task order's award. An example EE/CA SOW is provided on the OE MCX website at http:www.hnd.usace.army.mil/oew/contreq.htm.

b. Preparation of the IGE. The IGE for an EE/CA will be prepared in accordance with the guidance provided in EP 1110-1-18.

c. Site Visit.

(1) If the EE/CA contractor performed the RECON task, then a site visit should not be necessary. However, if a RECON was not included in the contractor's SOW, then the EE/CA contractor will conduct a site visit.

(2) Site Visit SOW. The site visit may be authorized as either a purchase order or as the first task of an incrementally funded contract. Sample SOWs for the stand-alone site visit and the site visit included as a task in a larger task order may be located on the OE MCX website at http:www.hnd.usace.army.mil/oew/contreq.htm.

(3) Purpose. The purpose of the site visit is to provide the contractor with the opportunity to gather pertinent information for use in preparing the Work Plan and other planning documents. The information collected from the site visit allows the contractor to gain a better understanding of the nature and extent of RCWM contamination and verify the locations of the proposed areas of interest. This information, which is instrumental in planning the EE/CA, includes:

(a) Site features, such as terrain, soil type, access, and amount of brush clearance required.

(b) Location of / coordination with nearest hospital.

(c) Location of / coordination with nearest fire station.

(d) Coordination with local airport/ Federal Aviation Administration representatives.

(e) Coordination with local police, sheriff, and/or military police to assess security.

(f) Fencing requirements for explosives storage magazines.

(g) Location for support zone and explosive storage magazines if applicable.

(h) Location of the IHF, if applicable.

(i) Logistical coordination for lodging, equipment and vehicle rental, office space, explosives dealers, etc.

(j) Coordination with Range Control, Defense Reutilization Management Office, Ammunition Supply Point, and Post Provost Marshal, if applicable.

(k) Coordination with TEU, ECBC, PMNSCM, and the district for support activities during field investigations, as applicable.

(4) Site Visit Requirements. The following paragraphs present requirements that should be fulfilled for the site visit:

(a) Prior to the site visit, the contractor will be provided with copies of the ASR and any other site-specific information for review.

(b) An ASSHP will be prepared and submitted to the OE Safety Manager or appointed designee prior to visiting the site. The ASSHP will be prepared using the format provided on the OE MCX website at http:www.hnd.usace.army.mil/oew/policy/regpro.html as Appendix H to EP 1110-1-18.

(c) Generally, no more than three contractor personnel are required to participate. One contractor participant must be a project manager and one must be a qualified Senior UXO Supervisor.

(d) Since the site visit will be non-intrusive and anomaly avoidance techniques will be implemented, site visit participants are not required to have Hazardous Waste Operations (HAZWOPER) training.

(e) The district will coordinate with the property owner/operator prior to the site visit if a ROE is required.

(f) A site visit for a typical project should take no longer than five days, including travel time.

d. Preparation of Planning Documents. A Safety Submission may be required prior to beginning work at the RCWM site (see Chapter 4). The Safety Submission is composed of the Work Plan, SSHP, and Supporting Plans. These elements of the Safety Submission are discussed in detail in

Chapter 7 of this document. If a Safety Submission is not required, a Work Plan and Safety Plan will still be required to conduct field activities.

(1) Work Plan. A site-specific Work Plan is required for all EE/CA projects. The Work Plan documents the methodology that will be used to complete the EE/CA. Following the site visit, the Work Plan will be developed in accordance with the SOW. The contents of an EE/CA Work Plan, including sub-plans, are discussed in this chapter.

(2) SSHP. The contractor will also prepare a SSHP in accordance with the guidance provided in Chapter 7 of this document.

(3) Supporting Plans. If a Safety Submission is required, the following supporting plans will be prepared in accordance with Chapter 7 of this document: TEU Assessment Plan, ECBC Air Monitoring and Analysis Plan, Public Evacuation or Shelter-in-Place Plan, and PMNSCM Plans.

(4) Public Affairs, Real Estate and Regulatory Requirements. During the EE/CA planning and coordination process, the district PM must ensure that all applicable public affairs, real estate, and regulatory requirements, as discussed in EP 1110-1-18 and EP 1110-3-8, have been satisfied. Additionally, the applicable safety and training requirements, as specified in Chapter 8 of this document must be fulfilled.

(5) Anomaly Review Board. The district PM may also consider the establishment of an Anomaly Review Board (ARB). An ARB is only used in exceptional circumstances. Information on ARB procedures is provided in EP 1110-1-18.

5-4. Site Characterization.

a. Overview.

(1) In general, RCWM sites are comprised of disposal pits and test trenches, and to a lesser extent, impact ranges. The purpose of a RCWM site characterization is to obtain surface and subsurface RCWM data to characterize the site and to generate recommendations for the proposed RCWM response action. This characterization should include any data from any RCWM that has been located and/or disposed of by EOD or local law enforcement. Potential sources for this data include the ASR, EOD records, or local law enforcement records. The following types of data should be collected:

(a) Type of RCWM or RCWM-related activities.

(b) Location of RCWM or RCWM-related activities, including location of pits or trenches.

(c) Density of RCWM munitions for impact areas.

(d) Penetration depth of RCWM munitions for impact areas.

(2) The components of the site characterization phase include:

(a) Implementation of the sampling methodology.

(b) OE detection instrument testing, if not completed during the RECON task.

(c) Area preparation.

(d) Field sampling.

b. Statistical Tools. During an EE/CA site characterization, the following statistical tools may be used to collect site-specific data for impact areas: SiteStats/GridStats or UXO calculator. Contact the OE MCX for additional detail on these statistical tools.

(1) SiteStats/GridStats. SiteStats may be used during sampling efforts to aid in establishing the boundaries of contaminated areas and estimating the density of contamination within an area. SiteStats provides for sequential sampling procedures and a statistical determination of sampling termination points. SiteStats accepts a small amount of uncertainty in characterizing individual subareas (grids) in exchange for a much greater understanding of the contamination of the overall site. GridStats provides a statistical sampling methodology for estimation of ordnance contamination density within individual grids.

(2) UXO Calculator. The UXO Calculator is a statistical model for determining the amount of UXO in a sector. The UXO Calculator assumes homogeneous OE contamination within an identified area. It is used to determine statistical confidence intervals for UXO density and to perform statistical tests concerning UXO densities.

(3) Other. Other statistical methods that are agreed to by stakeholders, documented and approved.

c. OE Detection Instrument Testing. OE detection instruments should be field tested prior to each project to ensure their applicability to the unique geographical characteristics of the site. If the RECON task is included in the EE/CA process, the OE detection instrument with the best documented performance for reasonable cost should be selected for the EE/CA field investigation. If the RECON task was not included in the EE/CA process, then the contractor should complete OE detection instrument testing as part of the initial field effort. The procedures for OE detection instrument testing are described in EM 1110-1-4009.

d. Area Preparation. Area preparation includes the identification and marking of geophysical sampling grids and the removal of sufficient vegetation and other obstacles which may restrict sampling efforts.

(1) Location Surveys and Mapping. Location surveys and mapping will be performed by the contractor to establish the boundaries of the areas under investigation. The procedures to be used in the execution of location surveys and mapping are discussed in EM 1110-1-4009.

(2) Brush Clearance.

(a) Prior to conducting any field sampling, brush clearance may be required. The purpose of brush clearance is to remove sufficient vegetative growth from the areas to be investigated in order to effectively locate, investigate, and remove subsurface anomalies.

(b) The vegetation removal techniques used must be coordinated with the district environmental staff and documented in the Work Plan. A UXO Technician II must always escort the brush clearing crew in areas not previously cleared of OE. The safety requirements listed in EM 385-1-1 must be followed. PPE will be provided to the brush clearance crew and used as required for protection. All brush clearance personnel must be trained in the safe operation of the equipment and have obtained site-specific safety training in accordance with Chapter 8 of this document.

e. Field Sampling. During the field sampling, surfaced and/or subsurface sampling are conducted to obtain the data necessary to conduct an accurate EE/CA investigation.

(1) Surface Sampling. The UXO personnel will visually inspect the site investigation area; identify grids; and locate any suspect RCWM items. TEU will assess, package, and transport each RCWM or suspect RCWM item to the IHF. The contractor will assist TEU as needed.

(2) Subsurface Sampling.

(a) Prior to the subsurface sampling effort, the contractor will perform a geophysical survey to locate subsurface anomalies. The procedures for conducting OE detection surveys are discussed in Chapter 6 of this document. RCWM or suspected RCWM identified by the OE sampling protocol will be intrusively investigated. Only approved UXO personnel or TEU will perform intrusive operations. RCWM removal actions will proceed in accordance with the approved Safety Submission.

(b) Once a suspect RCWM item has been exposed, TEU will assess, package, and transport the RCWM or suspect RCWM item to the IHF. The contractor will assist TEU as needed.

(c) If a suspect RCWM item is removed, then the excavated location will be rechecked with a magnetometer or other ordnance detector. Upon completion of the recheck, if the location does not

produce another anomaly, the excavated area will be sampled in accordance with Chapter 9 to determine if residual chemical agent contamination is present. If the area is determined to be uncontaminated, the area may be backfilled with clean soil. If the sample is contaminated with chemical agent, the on-site OE Safety Specialist will be notified.

(d) Evacuations are sometimes necessary when conducting intrusive investigations to minimize the risk of the operation. An exclusion zone distance is calculated to ensure that all non-essential personnel are outside of that distance during the conduct of the excavation. The exclusion zone distance may be reduced by implementing engineering controls.

(e) There are several other considerations, which must be accounted for during the intrusive investigation, including: engineering controls, exclusion zone management, and quality assurance. These topics are discussed in detail in later chapters of this pamphlet.

5-5. Engineering and Operational Controls.

a. Engineering controls are used to improve personnel safety and/or to reduce the exclusion zone during removal operations. If an engineering control design is required to reduce an exclusion zone due to fragmentation concerns, the USAESCH OE Design Center should be contacted for design approval by the USAESCH Engineering Directorate, Structural Branch. Examples of engineering controls for vapor containment for RCWM activities include:

(1) The use of environmental structures to reduce or contain the agent should a release occur (e.g., Vapor Containment Structure). This is usually accompanied by the use of an approved air filtration system to capture the agent vapors.

(2) Filtered Shelter (other than the Vapor Containment Structure).

b. Operational Controls. Examples of operational controls for RCWM are described below.

(1) RCWM operations should be performed during the hours of daylight.

(2) Certain temperatures can reduce the rate of release of agents. For example, H agent, or mustard, becomes a solid at temperatures below 57º Fahrenheit. If the chemical agent of concern was mustard on the project site, operations could be restricted to periods when the temperature would be below that temperature, thereby reducing the NOSE. Even at temperatures below 57º Fahrenheit, if the MCE is an ammunition round, explosively configured, containing H agent and the round functioned as designed, there would be a NOSE due to the release of agent caused by the heat generated by the explosion.

(3) Wind speed has a direct effect on downwind hazard distances. Normally the higher the wind speed, the more air turbulence exists, thereby reducing the downwind distance of the agent plume. Therefore, operations could be restricted unless the wind speed is at or above a certain level.

(4) Atmospheric stability. The time of day, the strength of sunlight (if any) in the area, the extent of cloud cover, and the wind velocity all play major roles in determining the level of turbulence in the atmosphere. Turbulence is the extent of "mixing" in the atmosphere. These factors determine distances downwind over which airborne contaminants will remain hazardous. Meteorologists typically divide atmospheric conditions into six atmospheric stability classes that generally range from "A" to "F". Class A represents unstable conditions under which there is strong sunlight, clear skies, and high turbulence in the atmosphere. These conditions promote rapid mixing and dispersal of airborne contaminants. At the other extreme, atmospheric stability Class F represents light steady winds, nighttime skies, and low level of turbulence in the atmosphere. Airborne contaminants mix and disperse much slower with air under these conditions.

5-6. Environmental Sampling and Analysis. Soil samples should be obtained from locations, which could potentially have been contaminated with RCWM or decontamination procedures. Soil samples should be obtained at intervals justified in the approved Work Plan. Sampling and analysis may also be required for investigative derived waste (IDW). Detailed information on environmental sampling and analysis is provided in Chapter 9 of this document.

5-7. Institutional Analysis.

a. Purpose. An institutional analysis should be conducted to show what opportunities exist to implement an institutional control program at a specific site (see Chapter 2 of EP 1110-1-24 for a discussion on overview of institutional controls and their relationship to land use controls). The institutional analysis also identifies the existence of any local, state, Federal, or private agencies that may be available to assist in the implementation or maintenance of the institutional controls program. An institutional analysis is necessary in order to evaluate whether institutional controls are viable at a particular site as a stand-alone response action or as a supplement to other cleanup activities. The institutional analysis will also aid in developing the most effective institutional control program, if it is selected as the response alternative or as part of a response alternative.

b. Components.

(1) There are five elements of an institutional analysis which should be evaluated for each local, state, federal or private agency that may be able to assist in the implementation or monitoring of a proposed institutional controls program. These elements include:

(a) Jurisdiction of the agency.

(b) Authority exercised by the agency within its jurisdiction.

(c) Mission of the agency.

(d) Capability of the agency.

(e) Desire of the agency to implement the institutional control being considered.

(2) For additional information on the application of institutional controls for the EE/CA process, refer to EP 1110-1-24.

c. Determination of Existing Institutional Controls. The existence of any current deed restrictions or other type of institutional control that may have been placed on the property in the past as a result of some other activity should be determined. If such restrictions are found to already exist at a site, it may be easier to modify the existing restriction to address the OE risk than to implement an entirely new institutional control.

5-8. Risk Characterization.

a. Purpose. A risk characterization is required as part of the EE/CA process. A risk characterization of a RCWM site is conducted to determine the level of safety risk that exists at a site as a result of the RCWM contamination. The risk characterization is a key component in determining the type of response necessary to address the safety risk and the basis on which subsequent cost-benefit analyses are conducted in the EE/CA.

b. Types of Risk Characterization Tools. Typically, a qualitative risk characterization tool is used during RCWM projects. For additional information on the selection of risk characterization tools, contact the OE MCX.

5-9. Development and Evaluation of Response Action Alternatives.

a. Development of Response Action Alternatives. Once site-specific data has been gathered and analyzed, potential site-specific response action alternatives will be developed. A response action alternative may include physical OE removals, as well as any other alternatives that reduce risk to the public. The alternatives will be developed based on existing site conditions, historic use of the site, the existing or proposed land use, and the extent and depth of OE. Site-specific alternatives must ensure the most effective use of resources, while providing maximum return to the public.

b. Response Action Categories. Response action alternatives are classified into four general categories: NDAI, Institutional Controls, Surface Clearance, and Subsurface Clearance. A proposed response action may include a combination of these alternatives.

(1) No DOD Action Indicated. This response action involves the continued use of the site in its current condition. An NDAI may be appropriate if some removal action has already occurred at the site or sector of the site or if the risk evaluation has determined that there is a very low-level of safety risk.

(2) Institutional Controls. Institutional controls may be used either as a stand-alone response action or as a supplement to other cleanup activities in order to address the residual risk that remains at a site after a response action has been completed. Institutional controls are a response action alternative used to restrict access to the site. Access can be restricted by either imposing administrative restrictions and/or by installing physical barriers. Administrative restrictions could take the form of a deed restriction limiting the future use of the parcel or requiring that precautions be taken during any future construction activities. Physical barriers may involve fencing and posting the area to ensure that the local populace does not enter the property and inadvertently come into contact with RCWM. For additional information regarding institutional controls, refer to EP 1110-1-24.

(3) OE Surface Clearance. The OE surface clearance alternative includes the investigation and removal of all potentially hazardous OE items IAW EP 1110-1-18. An OE surface clearance alternative may be recommended for a site based on the nature and extent of the OE contamination, the current and projected use of the site, and local community and regulatory acceptance of the alternative. An OE surface clearance must be performed by UXO-qualified personnel.

(4) OE Subsurface Clearance.

(a) The subsurface OE clearance alternative includes the investigation and removal of all potentially hazardous OE items to a certain depth at a site. The depth of the OE clearance is based on the nature and extent of the OE contamination, the current and projected use of the site, and local community and regulatory acceptance of the proposed alternative. When there is insufficient data to develop site-specific clearance depths, refer to DOD 6055.9-STD, Ammunition and Explosives Safety Standards, for subsurface clearance default depth. However, it is more cost effective to develop site-specific clearance depths based on current and future use of the site and the actual depth of OE found during the EE/CA investigation.

(b) An OE subsurface clearance is typically conducted using geophysical instruments to map the subsurface conditions and to determine the locations of anomalies that may be buried OE items. Upon completion of the geophysical survey and an analysis of the data, UXO-qualified personnel perform intrusive investigations to determine the nature of the geophysical anomalies.

c. Evaluation of Response Action Alternatives. Once the cleanup objectives have been established for a site, the various response action alternatives developed in the EE/CA must be evaluated in terms of how well they will meet these objectives.

(1) Three general evaluation categories are used to evaluate the proposed response action alternatives: effectiveness, implementability, and cost. The following paragraphs and Table 5.1 provide criteria which should be considered in the evaluation of each response action alternative.

(a) Effectiveness. The effectiveness of each response action alternative is evaluated based on its level of protection of human health and the environment, compliance with ARARs, and its ability to achieve the response action objectives. The effectiveness category is divided into four evaluation criteria:

- Overall Protection to Human Health and the Environment.
- Compliance with ARARs.
- Long-Term Effectiveness.
- Short-Term Effectiveness.

(b) Implementability. The implementability of each response action alternative is evaluated based on the following evaluation criteria including:

- Technical Feasibility.
- Administrative Feasibility.
- Availability of Services and Materials.
- Stakeholder Acceptance.

(c) Cost. The cost of each response action alternative is based on:

- Capital Costs.
- Post Removal Site Control Costs.

d. Comparative Analysis of Response Action Alternatives. Those alternatives which still appear feasible after the evaluation described above are then compared to each other using the same evaluation criteria described above. During this comparative analysis, the alternatives are ranked and the recommended response action alternative is selected.

Table 5.1

Criteria to Be Considered During Evaluation of Response Action Alternatives

Evaluation Category	Criteria to be Considered
Effectiveness	• Protectiveness: – Protective of public health and community – Protective of workers during implementation – Protective of the environment • Complies with ARARS • Long Term Effectiveness • Short Term Effectiveness
Implementability	• Technical Feasibility: – Construction and operational considerations – Demonstrated performance/useful life – Adaptable to environmental conditions – Can be implemented in 1 year • Administrative Feasibility: – Permits required – Easements or right-of-ways required – Impact on adjoining property – Ability to impose institutional controls • Availability of Services and Materials: – Equipment – Personnel Services – Outside laboratory testing capacity – Off-site treatment and disposal capacity – Post removal site control • Stakeholder Acceptance
Cost	• Capital Cost • Post-removal site control cost

5-10. EE/CA Report. The EE/CA Report documents the methodologies used during the site characterization and presents the findings of the EE/CA evaluation. The EE/CA Report is a flexible document tailored to the scope, goals, and objectives of the NTCRA process. It should contain only those data necessary to support the selection of a response alternative and future five-year recurring reviews. Existing documentation should be relied on whenever possible. A sample format for an EE/CA Report is presented in EP 1110-1-18.

a. The EE/CA Report is executed and approved by the USAESCH OE Design Center. The EE/CA Report is reviewed by the district and the OE MCX.

b. Explosives Safety Submission (ESS) Requirement During the EE/CA Process.

(1) An ESS is typically prepared as part of the removal action planning process, as discussed in EP 1110-1-18. However, an ESS is also prepared if the Draft EE/CA Report recommends the response action alternative of either NDAI or Institutional Controls. Examples of the content and format of an NDAI ESS and Institutional Controls ESS are available in EP 1110-1-18.

(2) Both the NDAI ESS and Institutional Controls ESS must receive concurrence from the USATCES and the Department of Defense Explosives Safety Board (DDESB). Once the ESS has been approved, and all other comments on the Draft EE/CA have been incorporated, the Final EE/CA Report may be prepared.

5-11. EE/CA Public Participation and Approval Process.

a. Once the EE/CA Report has been prepared and reviewed by the USAESCH OE Design Center, the OE MCX, the district, and other stakeholders, the EE/CA becomes part of the Administrative Record for the site. The EE/CA is made available for public review and comment. A formal 30-day (minimum) public comment period is required, during which time public meetings may be held to discuss the results of the field investigation and the alternative selection process. For additional information regarding public participation requirements refer to EP 1110-3-8.

b. Upon completion of the public comment period, a responsiveness summary is prepared that discusses any significant public comments received and the actions taken to address those comments. The responsiveness summary becomes part of the Administrative Record.

c. Once the comments received during the public comment period have been incorporated into the EE/CA, the final EE/CA, along with the responsiveness summary, become part of the Administrative Record for the site.

d. If OE remains or is suspected to remain after completion of a response action, the property owner(s) will be apprised through the Administrative Record or other written agreements and all documentation will be annotated accordingly.

5-12. Action Memorandum.

a. The Action Memorandum is a concise document that identifies the response action chosen for implementation at a site. The Action Memorandum may also reserve the appropriate funding needed for the proposed response action. An Action Memorandum is required prior to implementation of TCRAs and NTCRAs.

b. As the primary decision document for the RCWM response action, the Action Memorandum serves the following functions:

(1) Substantiates the need for the response action.

(2) Identifies the proposed action.

(3) Explains the rationale for the response action selection.

(4) Documents that the appropriate process was followed in the selection of the response action.

c. Additional information on the applicability of the Action Memorandum, its format, and the review and approval process is discussed in EP 1110-1-18.